**HPS Photoelectric Effect Sim Guide 2018 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

The **photoelectric effect** can be explained in the following way: when light strikes a metal surface, the surface gives off electrons (scientists refer to these electrons as photoelectrons) and is considered a photosensitive surface.

The photoelectric effect is considered an example of the particle behavior of light because it cannot be explained by classical physics.

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| The Photoelectric Effect | | | |
| # | Idea | Classical Predictions | Experimental evidence |
| 1 | Whether electrons are ejected is dependent on... | The intensity of light | The frequency of light |
| 2 | The kinetic energy of ejected electrons depends on... | The intensity of light | The frequency of light |
| 3 | At low intensities, electron ejection... | Takes time | Occurs most instantaneously above a certain frequency |

Directions:

1. Click on the following link: <https://connexions.github.io/simulations/photoelectric-effect/#sim-photoelectric-effect>
2. On the right side, select electron energy vs light frequency from the graphs menu. Remember, wavelength is related to frequency by c = λf. (1x10-9 m = 1 nm)
3. On the left side of the screen, you can select your metal from the drop down menu. Start with Sodium.
4. To turn on the light, select the wavelength of light from the color slider and then slide the intensity up from 0%.

Questions:

1. What wavelengths cause photoelectrons to be emitted for sodium, zinc, copper, platinum, and calcium. What frequency range does this correlate to?

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| --- | --- | --- |
| Material | Wavelength Range | Frequency Range |
| Sodium |  |  |
| Zinc |  |  |
| Copper |  |  |
| Platinum |  |  |
| Calcium |  |  |

1. How does your measured frequencies compare with the electron energy vs light frequency graph?
2. The threshold frequency is the minimum frequency of light that will cause the material to emit. What is the threshold frequency for each of the materials?

|  |  |
| --- | --- |
| Material | Threshold Frequency |
| Sodium |  |
| Zinc |  |
| Copper |  |
| Platinum |  |
| Calcium |  |

1. Explore the three ideas listed above and compare the classical predictions to the experimental evidence. Does your exploration support what is listed at the experimental evidence? Describe how you tested the three ideas above and the evidence you found:
   1. Idea 1:
   2. Idea 2:
   3. Idea 3:
2. What effect does changing the intensity have? Does it change your electron energy?
3. The photoelectric effect is used in many applications today. Look up three different uses for the photoelectric effect and explain how it’s used.